transformed them into a compressed data and send to the base station (BS). The number of Cluster Heads and S-CHs are initially decided by using a predetermined fractional value. In SCH LEACH, Minimize the overall communication distance between the nodes and Base Stations. The routing protocols LEACH, M-LEACH and Proposed algorithm have simulated in MATLAB. The average distance and average energy dissipation are calculated and compare the average energy and distance.

3. Proposed Algorithm

A. Design Consideration

Table1: Initial parameter

S. No.	*Name*	*Value*
1	Network Area	400*400 sq. Units
2	No. Of Nodes	50
3	Delay between subsequent Packet	0.2 unit
4	Packet Size	5 bit
5	Initial energy	500mJ

B. Description of Proposed Algorithm

Here in designing algorithm adaptive load balancing technique and traffic splitting protocol works with E-LEACH protocol.

Step I Cluster head formation: In clustering, each node takes part in cluster head formation. The process of cluster head formation on basis of battery consumption left. The battery having more power left is chosen to be cluster head. This whole processes takes place in following sequence:

1) First layer Cluster Heads are formed where the member nodes transmit the data to their respective Cluster Head and CH aggregate the received data.
2) Second layer super Cluster Heads are formed.
3) After the formation of Super Cluster Head (SCH), the CHs look for the nearest SCHs by computing the distance between the CH data to respective Super Cluster Head (SCH) in the similar like a LEACH.
4) The Super Cluster Head (SCH) received data from their Closest Cluster Head, aggregate all received data, transformed them into a compressed data and send to the base station (BS).
5) The number of Cluster Heads and S-CHs are initially decided by using a predetermined fractional value.

Step II Traffic Splitting Protocol: By enhancing the traffic splitting protocol (TSP) load balancing in the network easily. This improved traffic splitting protocol (TSP) in steady state phase uses each intermediated node sends the data during its own TDMA time slot. TSP consists of two methods.

1) Route assignment method uses the information collected about each route to calculate weight for route. In this method we select the path to be followed for sending packets from sender to receiver node. This selection is on basis of routing table we have in our record. We find shortest distance path from routing table.
2) Load sharing method select particular route for individual data dynamically at real time. This load sharing is done to reduce the load of each node sending data to other node. This load sharing ensures best use of available power in nodes.

Step III ALB: This routing algorithm avoids the occurrence of link overload, was put forward & increased the network resource utilization rate and ensured data transmission reliable. E-LEACH (Low energy adaptive clustering hierarchy) protocol includes additional parameter one is residue energy and second is consumed energy & two phases first phase is cluster set up phase and second is steady-phase. In cluster set up phase, cluster head avoid the lower residual energy node and select higher residual energy node.

4. Pseudo Code

Step 1: let load at 4 paths be L1, L2, L3 & L4.
Step 2: Start for loop path 1 >=4.
Step 3: if (L1 > T) \\ T is the load threshold.
Step 4: find difference in load D= L1 - T;
Step 5: if (L2 ' < T).
Step 6: put extra load to this path L2 = L2 ' + D; \\ L2 & L2 ' are the current and previous loads.
Step 7: end if condition;
Step 8: if (L3 ' < T).
Step 9: put extra load to this path L3 = L3 ' + D; \\ L3 & L3 ' are the current and previous loads.
Step 10: end if condition;
Step 11: if (L4 ' < T).
Step 12: put extra load to this path L4 = L4 ' + D; \\ L4 & L4 ' are the current and previous loads.
Step 13: end if condition;
Step 14: end if condition;
REPEAT THE STEPS 2 TO 14 FOR L2, L3 & L4 also.

5. Simulation Result

To get the simulation results MATLAB tool is used. As mentioned earlier, E-LEACH using ALB works in rounds. For our experiments the total number of rounds used is 20. E-Leach with TSP helps in proper routing of different nodes according to two different methods. First is route assignment method in which nodes are send according to routing weight of different paths, Second is Load sharing method in which routing of nodes is done in such a way that each nodes share same load. While in the case of ALB routing algorithm avoid the occurrence of link overload, was put forward & increased the network resource utilization rate and ensured data transmission reliable .E-LEACH (Low energy adaptive clustering hierarchy) protocol includes additional parameter one is residue energy and second is consumed energy & two phases first phase is cluster set up phase and second is steady phase In set up phase, all the nodes are being balanced according to the load. While in steady phase all the nodes transmit equal amount of information from source to sink. Simulations of E-LEACH using ALB in comparison with E-LEACH in which only one path is considered and E-LEACH using TSP in which paths are four but unbalanced performed to observe the average load, power left, power consumption, end-to-end delay, average jitter and overall PDR or throughput.

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A. Average Load: Figure 3 shown that the total no. of average load in E-LEACH using TSP is higher than the total no. of average load in E-LEACH using ALB also shows average load of E-LEACH using TSP (Traffic splitting protocol) & ALB (Adaptive load balancing).

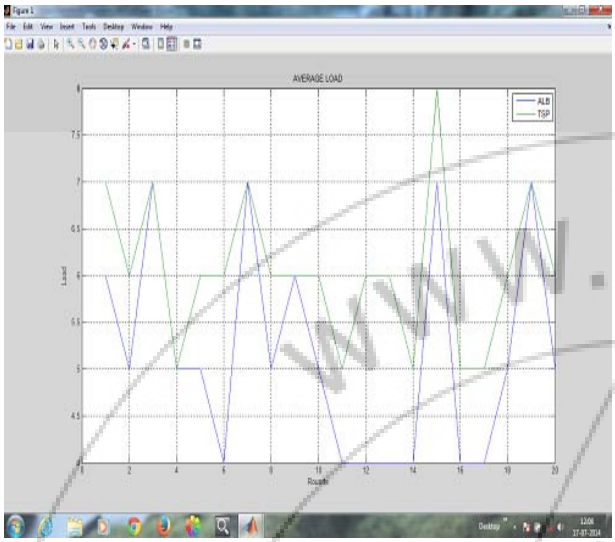

Figure 3: Total number of average load in E-LEACH routing protocol using TSP & ALB.

As ALB algorithm adaptively balanced the load in the network & gives better results in terms of network lifetime, end-to-end delay and throughput.

B. Power Left Comparison: Figure 4 shows the total number of power left after each round of E-LEACH, E-LEACH using TSP (Traffic splitting protocol) & ALB (Adaptive load balancing). The E-LEACH using ALB protocol has the overall network life of 10 rounds, while E-LEACH and E-LEACH using TSP has network life of 7 and 9 rounds respectively.

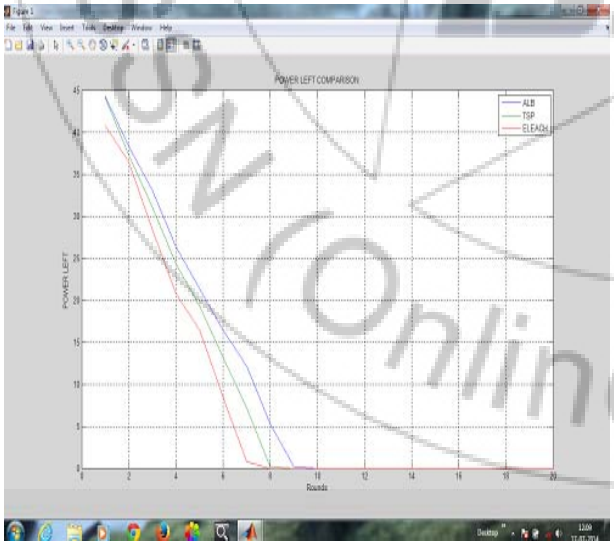

Figure 4: Total number of power left in each round in E-LEACH, TSP & ALB

This shows that our proposed protocol is about 30% and 10% better network lifetime than E-LEACH and E-LEACH using TSP respectively.

C. Power Consumption Comparison: Figure 5 shows the energy consumption comparison of E- LEACH having one path, E -LEACH using TSP having four paths but unbalanced unlike ALB and E-LEACH using ALB.

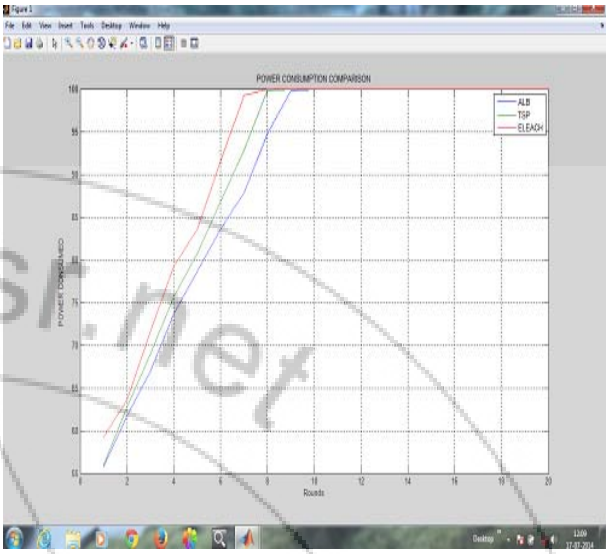

Figure 5: Total number of power consumed in each round in E-LEACH, TSP & ALB.

The E-LEACH using ALB protocol reaches the threshold level of 100 joules in 10 rounds, while E-LEACH and E-LEACH using TSP consumes 100 joules of energy in 7 and 9 rounds respectively. This shows that our proposed protocol is about 30% and 10% better in energy consumption than E-LEACH and E-LEACH using TSP respectively.

D. Throughput (Bits/s): The ratio of total data received by a receiver from a sender for a time the last packet received by receiver measures in bit/sec and byte/sec. It can be expressed mathematically as;
Throughput (bit/sec) = Number of delivered packet * Packet size * 8 *Total duration of simulation.

The throughput of the protocols can be defined as percentage of the packets received by the destination among the packets sent by the source. The throughput is measured in bps (bits per second). The number of bps must be high for a better system performance.

Figure 6 shows that throughput of E-LEACH using ALB is significantly greater as compared to E-LEACH and E-LEACH using TSP. Graph shows that the throughput of E-LEACH using ALB is more than the other two protocols because of adaptively load balancing in clustering and provide congestion free network.

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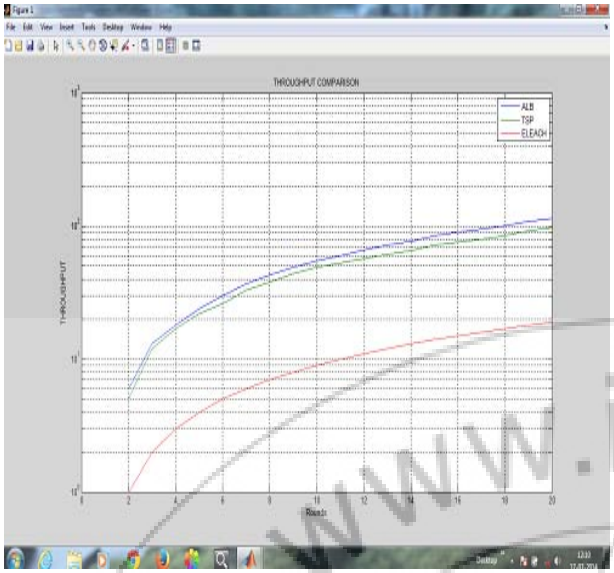

Figure 6: Comparison of E-LEACH, TSP & ALB Protocols with respect to Throughput.

Thus, it proves that E-LEACH using ALB has higher throughput as compared to E-LEACH and E-LEACH using TSP.

E. Average End-To-End Delay: Average End-to End delay is difference between the time at which the first packet was send by transmitter node and time at which that packet was being received by destination node. The Average of End-to-End delay in case of E-LEACH is maxim in case of ALB it is minimum and average in the case of TSP, as shown in figure ALB gives better result than the E-LEACH & TSP.

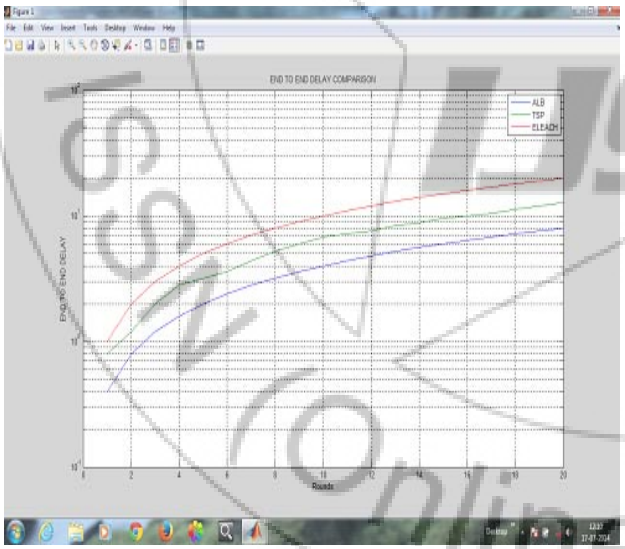

Figure 7: Comparison of E-LEACH, TSP & ALB Protocols with respect to Average End-to-end delay.

F. AVERAGE JITTER(s): Average Jitter is the time gap between the different packets arriving at the destination node. This may caused by network congestion, drift in time, different routing paths, and many more.

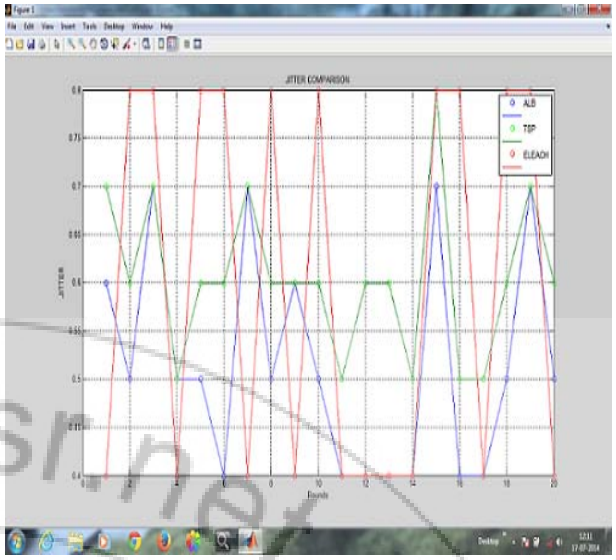

Figure 8: Comparison of E-LEACH, TSP & ALB Protocols with respect to Average jitter.

Average Jitter is maximum for E-LEACH, minimum for ALB and average in the case of TSP, as a network size of 100 nodes it is found that the jitter in the case of ALB gives better result than the E-LEACH & TSP.

6. Conclusion

Sensors are required to route packets as well as transmit the data to the base station. If more of these operations are performed the sensor battery life decays drastically. By using the proper communication protocol, the control of congestion and unnecessary data transmission or reception can help in better management of battery life. By considering the influencing factors such as congestion, energy awareness, scalability and latency, the purpose of this research is to find a congestion free energy efficient routing protocol for Wireless Sensor Networks.

7. Future Scope

In future the use of wireless technology will more prominent so reducing the consumptions of power of the devices involved in transmission/reception is the main requirement of the future. The investment of time and technology is being made to solve this problem and methodologies like LEACH, E-LEACH, ALB, etc. That helps in the cause of making wireless technologies more efficient.

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